

Listing of Claims

Claims 1-48 (canceled)

Claim 49 (currently amended): The apparatus of claim [44] 59, wherein the additive consumption inhibiting aldehyde comprises from about 0.001 g/L to about 100.0 g/L of the bath.

Claim 50 (currently amended): The apparatus of claim [44] 59, wherein the metal plating bath further comprises brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, or suppressors.

Claim 51 (currently amended): The apparatus of claim [44] 59, wherein the pH of the metal plating bath is from 0 to about 8.0.

Claim 52 (currently amended): The apparatus of claim [44] 59, wherein the metal salt comprises copper halides, copper sulfate, copper alkane sulfonate, copper alkanol sulfonate, or mixtures thereof.

Claim 53 (currently amended): The apparatus of claim [44] 59, wherein the insoluble anode comprises metals of cobalt, nickel, ruthenium, rhodium, palladium, iridium, or platinum.

Claim 54 (original): The apparatus of claim 53, wherein the insoluble anode further comprises metals of titanium, zirconium, hafnium, vanadium, niobium, or tantalum.

Claim 55 (original): The apparatus of claim 54, wherein the insoluble anode further comprises metals of beryllium, calcium, strontium, barium, scandium, yttrium, lanthanum, or rare earth elements.

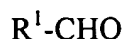
Claim 56 (currently amended): The apparatus of claim [44] 59, wherein the insoluble anode comprises iridium dioxide.

Claim 57 (currently amended): The apparatus of claim [44] 59, wherein the cathode comprises a wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolytic foil, a silicon wafer, a semiconductor, a lead frame, an optoelectronic component, a solder bump, a decorative article, or a sanitary appliance [and the like].

Claim 58 (currently amended): The apparatus of claim [44] 59, wherein the insoluble anode and the cathode have a current density of [from] about 1 to about 1000 amps/ft².

Claim 59 (new): An apparatus for electroplating a substrate comprising an electrical power source electrically connected with an insoluble anode and a cathode such that an electrical current can pass through the insoluble anode and the cathode, the insoluble anode and the

cathode are in contact with a metal plating bath comprising and additive consumption inhibiting aldehyde with a formula:



where R^1 is $(C_1\text{-}C_{20})$ linear, branched or cyclic alkyl; $(C_2\text{-}C_{20})$ linear or branched alkenyl; $(C_2\text{-}C_{20})$ linear or branched alkynyl; $(C_1\text{-}C_{20})$ alkyl- $O(C_2\text{-}C_3O)_xR^2$; $(C_1\text{-}C_{12})$ alkylphenyl- $O(C_2\text{-}C_3O)_xR^2$; or phenyl- $O(C_2\text{-}C_3O)_xR^2$; where x is an integer of 1-500 and R^2 is hydrogen, $(C_1\text{-}C_4)$ alkyl, or phenyl; the $(C_1\text{-}C_{20})$ alkyl, $(C_2\text{-}C_{20})$ alkenyl and $(C_2\text{-}C_{20})$ alkynyl may be substituted or unsubstituted; and a salt of a metal selected from the group consisting of copper, silver, palladium, platinum, cobalt, chromium, bismuth, indium, rhodium, iridium and ruthenium; and one or more brighteners having formulas: $HO_3SR^{11}\text{-SH}$, $HO_3S\text{-}R^{11}\text{-S-S-}R^{11}\text{-SO}_3H$ and $HO_3S\text{-}Ar\text{-S-S-Ar-SO}_3H$, where R^{11} is $C_1\text{-}C_6$ or an aryl group and Ar is phenyl or naphthyl.

Claim 60 (new): The apparatus of claim 59, wherein the $(C_1\text{-}C_{20})$ alkyl, $(C_2\text{-}C_{20})$ alkenyl and the $(C_2\text{-}C_{20})$ alkynyl are substituted with one or more substituents comprising halogen aryl, -SH , -CN , silyl, silane, -SCN , -C=NS , -Si(OH)_3 , -NO_2 , -SO_3M , -PO_3M , -P(R)_2 , -OH , -COOH , -CHO , $\text{-COO}(C_1\text{-}C_{12})$ alkyl, $\text{-CO}(C_1\text{-}C_{12})$ alkyl, or NR^3R^4 , where R^3 and R^4 are independently hydrogen, aryl, or $(C_1\text{-}C_{12})$ alkyl; and M is hydrogen, or alkali metal, and R is hydrogen or halogen.

Claim 61 (new): An apparatus for electroplating a substrate comprising an electrical power source electrically connected with an insoluble anode and a cathode such that an electrical current can pass through the insoluble anode and the cathode, the insoluble anode and the cathode are in contact with a metal plating bath comprising 2,3,4-trihydroxybenzaldehyde, 3-hydroxybenzaldehyde, 3,4,5-trihydroxybenzaldehyde, 2,4-dihydroxybenzaldehyde, 4-hydroxy-3-methoxycinnamaldehyde, 3,4,5-trihydroxybenzaldehyde monohydrate, syringaldehyde, 2,5-dihydroxybenzaldehyde, 2,4,5-trihydroxybenzaldehyde, 3,5-dihydroxybenzaldehyde, 3,4-dihydroxybenzaldehyde, 4-hydroxybenzaldehyde, 4-carboxybenzaldehyde, furfuraldehyde or mixtures thereof; a salt of a metal selected from the group consisting of copper, silver, palladium, platinum, cobalt, chromium, bismuth, indium, rhodium, iridium and ruthenium; and one or more brighteners having formulas: $HO_3S\text{-}R^{11}\text{-SH}$, $HO_3S\text{-}R^{11}\text{-S-S-}R^{11}\text{-SO}_3H$ and $HO_3S\text{-}Ar\text{-S-S-Ar-SO}_3H$, where R^{11} is $C_1\text{-}C_6$ or an aryl group and Ar is phenyl or naphthyl.